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APRIL 1910

STORAGE

Volume III, No. 6

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no.6
Biological
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ROYAL
III

TRANSACTIONS

OF THE

SOCIETY OF TROPICAL MEDICINE AND HYGIENE

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TRANSACTIONS

OF THE

SOCIETY OF TROPICAL MEDICINE

AND HYGIENE.

APRIL, 1910.

VOLUME III. No. 6.

Proceedings of a Meeting of the Society, on Friday, March 18th, 1910.

DR. F. M. SANDWITH, *Vice-President*, in the Chair.

THE DURATION OF LATENCY OF MALARIAL INFECTION.

By LIEUT.-COLONEL OSWALD BAKER, I.M.S. (Retired).

In bringing forward the subject of duration of latency in Malarial Infection, I must, in the first place, ask your permission to briefly refer to an attack of fever I suffered from in August of last year, which took place in Rhodesia. Before, however, proceeding to describe the symptoms of the attack, I would also ask you to bear with me while I relate, as far as it is relevant to the case, my medical history.

I joined the Indian Medical Service in the year 1873, and was posted to Burma, where for the first eight years I had good health. Being then sent to Akyab, a seaport on the Arracan coast, where malaria was, and had been from time immemorial, very prevalent and often severe, so much so, that the disease was spoken of as Arracan fever, as if it were a distinct entity, I became infected, and subsequently had several attacks of well-marked fever whilst in India. I need make no further reference to these attacks, except to say there was no doubt whatever as to their origin and nature. I finally left Burma for England in July, 1896, and from that date until I arrived in Rhodesia in August last, a period of 13 years, I had remained perfectly free from fever. During the interval, although I had occasionally seen mosquitoes, I had never to my knowledge been bitten by one.

I set out on my journey to Rhodesia on the 7th of last August, on board a Union-Castle line steamer bound for Capetown. The steamer called at Madeira on the way, where she remained for some hours. In order to obviate any suspicion arising that I might have become re-infected there, I will read an extract from a letter since written by Dr. GRABHAM, who resides on that island. "My son, Dr. MICHAEL GRABHAM, of Jamaica, who has a thorough knowledge of the subject, investigated the mosquitoes of Madeira and the Canaries quite recently. He found no species of Anopheles here, thus confirming the observations of many others. There are five or six species of Culex, all of them well known."

I reached Capetown on August 24th, at 10 a.m., after a voyage of seventeen days; and two hours later went straight on to Kimberley, from there to Johannesberg, and thence to Bulawayo, in Rhodesia, where I arrived on

September the 1st, eight days after landing in Capetown, I did not see a mosquito of any kind in South Africa until I reached Bulawayo. I then thought it desirable to begin taking quinine, and I took my first prophylactic dose of 3½ grains the following morning. After lunch on that day, the 2nd of September, I felt a little flushed, which I put down to exposure to the sun, but, in the course of an hour or so, the familiar symptoms of the onset of malarial fever, such as languor, slight muscular aching, and a desire to bend and stretch the body set in, and by 7 p.m., on my return from a motor drive to the Matopo Hills, I had well-marked fever, my temperature being 102° Fahrenheit.

Instead of going to dinner I went to bed, and Dr. CLARK, of Bulawayo, hearing by accident of my indisposition, very kindly came to see me. He insisted on my removal to a nursing home, an admirably equipped institution belonging to and presided over by a Miss Millar, which was close by; and, notwithstanding my urgent representations that I could take any ordinary dose of quinine, he likewise insisted on injecting 12 grains of that drug into the deltoid muscle of my left arm.

The fever lasted for 30 hours, and then disappeared. Precisely 72 hours after the onset of the first attack, I had a well-marked recurrence, but the temperature on the second occasion did not rise above 101°, although the febrile stage was of slightly longer duration. Between the two attacks I was quite free from fever, though far from well; the note made at the time being, "Feeling very slack and unequal to any exertion," and after the second attack I wrote, "Disinclined to move, and feeling quite unwell." Between the two attacks I took about 13 grains of quinine daily, but after the second attack I used

the drug more freely. Subsequently to the second attack I regained my normal state of health, and kept well for the remaining period of my absence from England.

The first attack of fever set in on the 2nd of September, and the second on the 5th. During the a-febrile period between the attacks, I made two dry films of my blood, and one wet film. The wet film I examined at once, and found therein a large leucocyte containing 6 or 7 small clumps of pigment near its periphery. On my return to England, I sent one of the dry films to Dr. DANIELS, and the other to Dr LOW, and asked these two gentlemen kindly to examine them. In neither were malarial parasites present, but Dr. DANIELS, who made a differential leucocytic count, found that 19 per cent. of the leucocytes were of the large mononuclear variety.

Such then are the data from which I have been forced to the conclusion that the attack of intermittent fever I suffered from in Bulawayo was unquestionably malarial. It was typical in regard to character and suddenness of onset, periodicity, the presence of melanin in, and also the leucocytic components of, the blood; the last feature alone being sufficient, according to STEPHENS and CHRISTOPHERS, to decide its nature. These painstaking investigators have expressed this view in the following words:— "We found that an increase beyond 15 per cent. of the large mononuclear forms (of leucocytes) is proof of an actual or recent malarial infection."

Admitting that the attack of fever was of a malarial nature, it follows that malaria must have been latent in my system for 13 years, or that I had become re-infected since I left India in 1896. During these 13 years, apart from my recent visit to Rhodesia, I have been out of England on four occasions. On the first occasion I went

to Marseilles, on the second and third to Egypt, and on the fourth, which was in 1908, to the Canary Islands. The visits to Marseilles and the Canaries may, I take it, be left out of consideration, but it remains to be seen whether infection could have been possible in Egypt. Now both my visits to that country were confined to the months of November and December, the first in 1900 and the second in 1902. To the best of my recollection, I did not see a single mosquito on either occasion; moreover, Dr. SANDWITH, who practised in Cairo for many years, has been kind enough to inform me that he has never known malaria to be contracted either in Cairo or Helouan during the winter months by a European visitor.

In the discussion which followed Dr DANIELS' address on the Persistence of Protozoal Tropical Disease in Man, read at the last annual meeting of the British Medical Association, Dr. BREINL, of Liverpool, stated he was able to relate a case of recurrence of malaria in a patient after an interval of seven years. Dr. BREINL does not say that his patient had not been exposed to re-infection in that interval, but the inference that no snch exposure took place is, from his silence on the matter, unavoidable.

In the instance of recurrence which I have now brought forward, and, I venture to think, substantiated, the persistence of latency was of thirteen years' duration.

From a consideration of the foregoing circumstances it must, I think, be affirmed that the limit of the duration of latency is not known. The subject does not seem to have received an amount of attention at all commensurate with its importance, or, at any rate, if due regard has been given to the question by those best qualified to answer it, the conclusions arrived at have not, so far as I am aware, been published.

For my part, I had grown old in the belief that if a person, who was subject to malarial attacks, took up his abode in a malaria-free country, and remained exempt from any manifestation of malaria for a period of three years, he might consider he had quite got rid of the infection: in other words, that the plasmodium of malaria could not exist in a latent state beyond a period of three years. But I have now abandoned this belief, which I feel sure is erroneous.

We know, or rather we do not know, the length of time that the bacillus of leprosy can exist in the human body without undergoing any active development. In many instances the bacillus, or its ultra-microscopic spores, gain admission to the tissues of man, and for twenty or thirty years produce no symptoms of their presence. Similarly in dysentery, and possibly other specific diseases, the germs of the diseases in question may be acquired, and may persist without producing any manifestations for very long periods of time, if at all.

When I was seeing out-patients at the Seamen's Branch Hospital some years ago, a man, past middle-age, came for treatment, suffering from typical dysentery. I got him admitted into the wards where he was in due course cured. The man had never had dysentery before, but some twenty years previously he had lived for a time in Calcutta; and I know of several cases in Anglo-Indians wherein dysentery, acquired in India, has remained latent for many years, and then has re-appeared in England.

In his article on Sprue, in Allbutt and Rolleston's System of Medicine, Sir PATRICK MANSON states that the capacity for latency in tropical diseases is very remarkable.

Several of the Fellows of this Society have, I feel sure, been called upon, often as a last resource, to see patients

who were suffering from diseases common to this country, in the belief that a malarial complication existed, simply because such patients, at some past period of their lives, perhaps twenty or thirty years previously, had either dwelt in or visited a malarial country.

Moreover, it is by no means rare to see in the columns of the medical journals, all sorts of anomalous symptoms attributed to malaria, for no other reason than that the sufferer had, at some time or other, lived in a country where malaria was an endemic disease.

I remember once reading in a medical journal, a clinical lecture on the existence of chronic malarial headache among Anglo-Indians living in England; but, during many years practice in a malarial country, I did not meet with malarial headaches, other than temporary attacks due to malarial pyrexia. Headache is a common accompaniment of anæmia, whether the anæmia results from malaria, or any other disease, but whatever be the cause of the anæmia, the character of the headache is the same.

In the few cases of suspected malarial complications in Anglo-Indians, who had long previously returned to this country, to which I have been summoned, I have not, I must admit, found any evidence of malaria.

Owing, however, to the belief that the latency of malaria was of limited duration, I did not expect to find any traces of that disease; but for the future I shall approach such patients with an unbiassed mind.

NOTES ON SOME CASES OF FEVER WITH AN URTICARIAL RASH, OCCURRING IN THE YANGTSE VALLEY.

By ALEXANDER C. LAMBERT, M.D.

The unclassified fevers of the tropics and sub-tropics are always interesting studies to those called upon to treat them, so that one may be pardoned, perhaps, for endeavouring to add to their number by describing in the following notes a group of symptoms, the cause of which apparently so far has eluded discovery.

Of late years, medical men, stationed in the Yangtse Valley, have noted the appearance, in summer and autumn, of a disease characterised by fever, rash and general symptoms, pulmonary or alimentary, or both combined, accompanied also by a good deal of prostration, and followed by a protracted convalescence, which happily ends in complete recovery in the vast majority of cases.

The description of the disease that follows is as it is seen in European patients, as the writer has not encountered the complaint amongst the Chinese, at all events in its early stage when the typical exanthem is present; but it is quite possible that, as the native usually does not present himself for treatment during the first few days of his illness, many cases of "fever," which are not traceable to any known cause, and are very resistant to treatment, would prove to be the post-exanthematous stages of what may be called, for want of a better term, Urticarial Fever.

Although the causal agent has not been described, there would appear to be a definite relationship between

physical contact on the part of the patient with the mud in paddy-fields, and creeks, and shallow lakes emptying into the Yangtse, and the subsequent development of the disease a few days later. It would seem also that it is risky to expose the naked skin to the muddy water by such means as wading bare-legged in paddy-fields when out shooting, or bathing in the shallow lakes and ponds which abound near the river. We therefore find the disease to occur most frequently amongst the crews of the river gun-boats, whose duties may take them into the mud, and amongst those ardent sportsmen on shore, who for comfort are inclined to discard, so far as is practical, the conventionalities of dress, and wade bare-legged through the paddy after the ubiquitous snipe; while those of us who take a less strenuous view of the sportsman's duty, and go clad in stockings and putties, may walk through the mud with impunity.

Under the circumstances it is difficult to set a definite incubation period, but it would appear to be about ten days to a fortnight. Premonitory symptoms, if present, are headache and malaise, with perhaps slight cough, and an evening rise of temperature to 100° or 102° F. In some cases there are definite gastric symptoms, vomiting, diarrhœa, and epigastric pain, for two or three days before the rash makes its appearance. In mild cases the rash is the first sign that the patient notices. This eruption, unlike that of most pyrexial states, is of an urticarial type. It appears on any part of the body as a small wheal which rapidly assumes a large size, attaining frequently 3 inches to 4 inches or more in diameter. These wheals are firm, white and raised from the surface, feeling to the touch like a solid œdema, and having frequently a central pinkish area of congestion and a

well marked areola. They remain "out" for an hour or two, continuing to spread. As they disappear the central part first resumes the normal skin appearance, the areola fading last of all, so that on examination of the patient, one finds the patches in all stages of development from the early wheal as large as a sixpence to sinuous, raised, red lines, the outlines of former areas, some of which measure several inches in circumference.

The eruption may continue to appear and fade away and re-appear for a week or more. It leaves no mark nor trace behind it, and does not avoid parts of the body that it previously favoured. The patient may be practically free from it for many hours when it again makes its appearance with renewed vigour. The irritability of the rash varies considerably, but taken generally is not so annoying as that of simple urticaria. It is frequently noticed that, when the rash is well out, the patient feels better, although there may be no remission of his fever at night. Dermatographic wheals can be elicited in many cases.

The temperature is normal or but slightly raised in the mornings. It commences to rise about noon, and reaches its height, which is seldom above 102° F., about six in the evening, from thence gradually falling to normal, its decrudescense being accompanied usually with sweating. The presence or absence of the rash has no effect upon the temperature, *which may continue for days after all signs of the former have disappeared.*

The pulse rate taken as a whole is comparatively slow, and in some cases is below normal, even when there is fever present, in an average type of case it may be expected to be from 60 to 70 in the morning, and from 75 to 85 at night. There is nothing special to be noted

as to its volume or regularity, it does not become dicrotic but if abnormally slow may intermit.

The effect of the disease on the respiratory passages is one of the most interesting and important, particularly important from the point of view of diagnosis, as the symptoms referable to these parts may be assigned to much more serious causes, such as tuberculosis, pneumonia, pleurisy with effusion, or empyema.

The urticarial rash frequently appears on the mucous membrane of the buccal cavity and also on that of the nose, in the latter position causing temporary impediment to respiration through the nostrils, the blockage passing off to the accompaniment of a profuse discharge of watery fluid. The larynx may also share in the transient œdema, but never, so far as is known, to a dangerous extent, the slight embarrassment to respiration caused by the swollen mucosa soon passing off. So far as the lungs themselves are concerned, the principal symptom is cough accompanied by more or less secretion. This may be distressing to the patient, coming on in paroxysms at irregular intervals, and heralded by tightness in the chest. But it is the physical signs which puzzle the practitioner. Perhaps on his first examination he finds dulness over one or other base and hears a fine crepitant râle, which makes him think of pneumonia. Possibly the rash has not yet made its appearance, and the patient does not seem ill enough for an incipient pneumonia, so he is put to bed, and the diagnosis left in abeyance for the present.

The following day the rash may be out, and the patch of dulness in the lungs may have quite disappeared, the air entering freely. The attendant, glad that he has not committed himself, begins to hedge and directs his attention to the alimentary tract. If, as is possible, there is anorexia

or diarrhœa and vomiting, he thinks that he may safely say "ptomaine poisoning," and probably does so. After a day or two, the patient in the meantime having been treated *secundum artem*, attention is again directed to the respiratory tract by a return of, or if it were never entirely absent, by an increase in the cough. Further examination of the chest reveals a new area of dulness, involving perhaps the whole of one lung; the breath sounds are distant and fine crepitations again heard. The respiratory rate is not however increased to the extent to which one would expect from the physical signs. A day or two more is allowed to elapse before another change in diagnosis is made, when, to the surprise of the examiner, he finds, on listening to the chest, that the lung, which the evening previously was apparently out of commission, is now admitting air freely, while the opposite fellow-organ is in the same condition from which its mate has emerged, though a few hours before it appeared to be healthy. And so it will go on from day to day in spite of treatment, to the wearying of the patient and the driving of his doctor to despair. Examination of the sputum has so far thrown no light on the etiology: in cases in which paracentesis has been performed with the idea of finding fluid or pus, neither the one nor the other has been forthcoming. In some cases the symptoms are distinctly more gastric and intestinal than pulmonary. All types suffer from anorexia and furred tongue, and, in most of the gastric forms, examination of the lungs will show areas of dulness, and some amount of cough will be present; but diarrhœa and vomiting are more marked in some cases than in others, while some may require treatment for constipation. In one case the symptoms

were of a dysenteric type with the passage of frequent but not very painful motions, composed in large part of a honey-coloured mucus and blood which contained filaria-like bodies, motionless and lying in proximity to what appeared like cast-off sheaths. Unfortunately the slide containing these bodies has been lost, but they were not found in the subsequent examinations of fæces from the same case or in other cases. In some cases definite epigastric pain is complained of, in others lumbar pains. It was noted that the rash in the cases with marked gastric symptoms was more persistent than in the pulmonary types, and that when it was profuse the intestinal symptoms were less distressing than when it was slight.

The condition of the blood is interesting, but so far as the writer is aware no protozoal organism has been found in it which might be the cause of the symptoms. As might be expected, a steadily increasing eosinophilia is encountered from the commencement. It reaches a high degree, in one case to 40 per cent., and gradually disappears as normal health is regained. It is probably useless to expect much change for the better while the percentage of eosinophiles remains high. There is always a certain amount of anæmia present, which increases if the case is a prolonged one: it is not uncommon to find the red-cells reduced to 3,500,000 after three weeks of fever. At first there is a leucocytosis, but latterly, even with the eosinophilia, the leucocytes may be reduced to 6,000 — 4,000, the brunt of the decrease falling on the polymorphonuclears. Repeated examinations of the blood for parasites conducted at all times of the day and night failed to discover any. Neither in the œdema fluid from the patches of urticaria was anything abnormal found. The urine is of the usual

febrile variety, diminished in quantity, with high specific gravity and increased urates: there was no albumen present in the samples from our cases. Microscopically, nothing could be discovered which could throw a light on the etiology of the disease. In several cases the spleen was found to be palpable. The liver in one case was said to be enlarged.

The duration of cases of this type of fever varies considerably. In the milder sort the fever has disappeared at the end of a week or ten days, the patient regaining his normal health at the end of a month. In all cases convalescence is comparatively protracted, and in the severer types in which the fever lasts from three weeks to a month, restitution to complete health may be delayed for two or three months after all fever has disappeared. In these cases the temperature about the end of the second or third week begins to fall by lysis, the morning temperature being sometimes below the normal. Frequently when the temperature has reached as low as 99° in the evening, it will remain at that level for days at a time, and it is at this stage that change of air, quinine and a generous diet are indicated and speedily work a cure. Dull areas in the lungs may be found on auscultation after the fever has left and the patient has returned to his duties, eats well, and no longer coughs. These gradually clear up without any untoward symptoms. The loss in weight is regained slowly in spite of the good appetite, which is a feature of convalescence.

Treatment in the acute stage is unsatisfactory. Most cases are benefitted by salines and small doses of calomel.

Quinine has little effect on the early temperature, but later, when it is commencing to fall, it seems to be as good a drug as there is. Salol is disappointing.

Santonin is usually exhibited at some time during the course of the disease, but without effect. Dr. THOMSON, of Hankow, has found the calcium salts useful. Naval surgeons find Izal baths allay the itching of the rash. During convalescence, tonics, arsenic and cod liver oil are indicated, while change of air if it can be arranged, is a great help.

As to the cause of this troublesome complaint, it still, so far as we are aware, eludes discovery. Truth to say, a good many people decline to admit that the symptoms described do represent a definite and specific disorder, and are inclined to call the cases in which they occur as aberrant forms of well-known diseases—notably typhoid, tuberculosis, and ptomaine poisoning. However, the usual tests for the first two mentioned fail to prove their presence, and the duration of the cases is unlike what is usual in ptomaine poisoning.

It is hoped that the members of this Society will be sufficiently interested in the subject to give their views on it, and perhaps suggest in which direction it would be best to prosecute researches to discover the cause. Our idea is that the urticarial manifestations are responsible for all the symptoms, even the pulmonary and the intestinal; that the patches of œdema as noted on the skin and visible mucous membranes occur also in the alveoli of the lungs, on the pleura and in the mucosa of the bowels, and that their transient presence in these regions accounts for the confusing physical signs.

The cause of the continued pyrexia is another matter, and would point to some toxin of a resistant nature. Taking all these things into consideration, that the cause will be found to be protozoal or bacterial is probable; and the former for choice. From what we have learnt of the

apparent relationship of the infective agent to the mud of ponds and lakes, and that those who do not expose the unprotected skin to the action of the muddy water escape, it would seem that the carrier of the infective agent is either a biting water-haunting fly or insect, or some mud-dwelling animal of similar propensities. The disease is not in itself dangerous to life, but any disorder which may keep a patient an invalid for two or three months, is worthy of investigation.

A résumé of several cases is added to these notes. For much help and information the writer is indebted to the Surgeons on His Majesty's ships on the China Station, some of whom have themselves been victims of the disease and have kindly described their own symptoms; others have sent the histories of cases under their care, or described an outbreak.

To all of them the writer is profoundly grateful.

Notes on Cases.

Case I.—Surgeon G. B. Scott, R.N., describes his own symptoms. First fell ill on June 6th, 1909, while proceeding in ship from Kiukiang to Hankow. Temp. 100·6, headache and slight diarrhœa; vomited once.

June 7th.—Arrived Hankow. Evening temp. 102.

June 9th.—Removed to Hankow hospital. Temperature remained between 100 and 101 till June 11th, when it began to fall, and June 13th it was normal morning and evening. Headache continuous for whole period. No diarrhœa or nausea after June 9th. The pulse was always between 48 and 56, usually 52. As the temperature became normal the pulse increased. No rash swellings or abnormal pain, or pains in the limbs or joints.

June 15th.—Left hospital, and proceeded to join the ship at Changsha. Left Changsha June 26th. On the evening of 25th, slight malaise ; 26th, temp. 101 ; 27th, temp. M. normal, E. 100 ; 28th, temp. M. normal, evening not taken because proceeding in passenger steamer on duty to Shanghai, but probably there was a nightly rise, as profuse perspiration occurred each night although the weather was cool.

July 1st.—Arrived Shanghai, and was very busy for the whole afternoon, and did some walking. Fell ill in the evening, and found temperature 102.

During July 2nd, 3rd and 4th, had swellings on the legs, face, hands and fingers. Those on the legs were largest, some 2 inches to 3 inches, red and itching and pitted on pressure, raised about ¼ inch above surface of skin. Those on face and hands smaller but very irritable.

Other symptoms :—1. Burning sensation in nose and post. nares with copious discharge of watery fluid, and swelling of nasal mucous membrane, preventing breathing through the nose. These attacks last only about a quarter to half an hour, and entirely disappear, leaving the nose quite free to breathe through. 2. One attack of giddiness while lying in bed.

July 5th.—Went into hospital in Kiukiang, and remained there for a fortnight. For twelve days the temperature was 99 in the morning and 102 at night. Sweated every night. Felt pretty well through the day. No more urticarial spots appeared, but fugitive patches of dulness could be elicited over the lungs, and where present the breath sounds were diminished in intensity.

Treatment consisted of an initial dose of santonin, which produced no helminths, and this was repeated with similar negative results. In addition, quinine,

salol and beta-naphthol were given without much effect. After the temperature had been normal for two days, I was transferred to Shanghai, and from thence to sick-quarters at Wei-hai-wei. In about six weeks I was convalescent and resumed duty, and am now, Jan., 1910, in excellent health.

Blood examination:—No parasites found. July 5th, marked eosinophilia. Different count showed:—

Eosinophiles	22 per cent.
Polymorphs	49 „
Basophiles	2 „
Large Mononuclears ...	9 „
Lymphocytes	18 „

Total reds per c.mm., 3,700,000; whites, 4,000.

Blood counts on 14th July:—

Eosinophiles	8½ per cent.
Polymorphs	70 „
Mononuclears	3 „
Lymphocytes	18½ „

Stools examined for ova and helminths, but none found.

Spleen enlarged and easily palpable.

The above is an example of the pulmonary type. It is possible that the attack of fever in Hankow was not connected with the urticarial attack. The patient was in the habit of walking bare-legged in the paddy when out shooting.

Case II.—G. E., Able Seaman, R.N., admitted to St. Vincent's Hospital, Kiukiang, suffering from fever, nausea and diarrhœa. Previous history of syphilis. Face flushed, some prostration, temp. 101·4, pulse 96. A peculiar eruption of urticarial type present on body and limbs, consisting of large, flat elevations, white in colour with slight blush in centre and surrounded by narrow red

areolæ; somewhat insensitive to needle prick, and itch a good deal, particularly on the limbs. When pricked and pressure applied, serum can be made to exude. Blotches remain a few hours and then fade, tending to assume a crescentic outline, and varying in size from a sixpence to a five-shilling piece. Tongue furred in centre with red edges.

9th.—M. temp. 99·6, pulse 74. A fresh crop of blotches appeared during the night. There has been a good deal of gastric distress and passage of flatus. There is a little cough; mucous rales heard over posterior portions of lungs, with an area of dulness and increased vocal resonance below L. scapula. Tenderness on pressure along line of intercostal nerves at same level, also tenderness on pressure over posterior triangles of neck. Slight headache last night, none this morning. Face swollen under and around eyes and over malar bones.

10th.—Mucous diarrhœa during yesterday afternoon. Examined mucus this morning and found many filariform larvæ (?) dead. A fresh set of blotches came out this morning, and again about noon. Most of them had disappeared by 7 p.m. Patient complained this afternoon of pain on movement between the scapulæ and along the back. He has an apthous ulcer on the tongue, and an anæmic patch or blotch on the R. pillar of fauces.

11th.—Passed a good night. Motion passed this a.m. contained some blood, not intimately mixed with the stool, possibly from a hæmorrhoid. Blotches still continue to appear.

Blood count:—

Eosinophiles	... ...	6 per cent.
Polymorphs ...	... ...	48 „
Lymphocytes	... ...	40 „
Mononuclears	... ...	6 „

12th.—Fever not above 99 to-day. Tongue cleaner, but appetite poor; feels inclined to vomit. Blotches still appear, but fewer in number. Lung symptoms remain the same; there is still cough and expectoration. Nothing found microscopically in the sputum. Night blood examined, nothing found. Also fluid from blotches, with no result. Cannot find any more of the filariform bodies in the stools.

13th.—Not feeling so well to-day: diarrhœa has returned, temp. 4 p.m., 100·8. Stools offensive and contain a little blood and mucus intimately mixed. Blotches continue to appear at irregular intervals. Has cough and expectoration, and vomits occasionally.

14th.—Temp. normal at 8 a.m. Pulse 62. Rectal exam. reveals nothing. Stools inclined to be pea-soup. A few râles over left base. Areas of diminished resonance over R. and L. lungs.

Blood Count:—

Eosinophiles	... ...	16 per cent.
Lymphocytes	... ...	20 ,,
Transitional	... ...	17 ,,
Polymorphs...	... ...	52 ,,
Mononuclears	... ...	5 ,,

15th.—Diarrhœa has diminished under sedative treatment; patient feels a little better. Blotches not so marked. Expectoration free.

16th.—Patient better; stools infrequent. Begins to feel desire for food. E. temp. 99·2. Can palpate spleen. Tongue is cleaner.

17th.—Patient clamouring for food. Passed semi-solid motion, sour odour. A good crop of blotches came out on arms at 9 a.m.

18th.—Patient feels better and asks for food. Passed two semi-solid motions. Blotches are smaller, but more numerous. M. temp. 98; E. temp. 99. Pulse 60 and 72.

19th.—Patient sent by steamer under care of surgeon to Shanghai, and subsequent history unknown.

The above is an example of the intestinal type. The patient had lately come from Changsha on the Tunting Lake, to which place several of the cases could be traced.

COMMUNICATED BY STAFF-SURGEON J. VERDON, R.N.

Case III.—C. G., aged 25, came sick on September 9th, complaining of headache and indefinite pains in the abdomen. Bowels irregular; temp. 102·4. He was given calomel every two hours until bowels reacted, which they shortly did.

On 16th urticarial patches appeared all over his body: his eyelids and hands became œdematous, but not so his feet. No patches were visible on the palate. The rash was of a giant character, some of the patches occupying space about the size of the palm of the hand, and were accompanied by intense itching. For want of a better name I called it Urticaria Ferox. He was now given Izal baths frequently, and doses of mag. sulph., which eased his condition. His skin remained quiescent for four or five days, and again the patches appeared. Blood examination showed a leucocytosis with eosinophilia. I now gave him santonin for three days according to Manson's method — result, none of the ordinary intestinal parasites in the stools.

His condition gradually improved under mag. sulph. and Izal, and he was sent to duty on the 7th October.

Remarks.—Three similar cases occurred, none of whom could assign any cause for their condition. They all lived in different messes, and were the only ones in their messes affected.

The temperature chart of this case is appended. These cases occurred whilst the vessel was in the Tunting Lake.

Case IV.—Mr. A. M., Imperial Maritime Customs of China, keen sportsman, amateur jockey and athlete. A teetotaler, and inclined to early rising; fond of bathing in the river; used to go out snipe shooting in the autumn before breakfast, and when heated would bathe in the ponds. November 11th, 1909, complained of not feeling very well. Had cold in the head and cough. Was given aspirin and stayed in the house that day. Next day felt better and went to the office. Felt seedy night of 12th, and took temperature, which was 102. Stayed in bed next day and was seen about 10 a.m., when temperature normal. Previous health had always been good; no history of phthisis, dysentery, or liver disorders; had had malaria three years previously, but since that time had not lived in a malarial district. Had come to Kiukiang from Shanghai four months previously, and had enjoyed the best of health during the hot weather. Temperature evening of November 13th, 101; pulse 80: pains in back and limbs and along course of intercostal nerves. Some cough present with scanty expectoration. Percussion showed slight impairment of resonance over left base; auscultation, fine crepitant râles on deep inspiration, breath sounds also diminished in intensity over same area. Was given a purge and aspirin. Temperature normal morning 14th, but rose to

100·8 at night. November 15th, morning temperature 98; evening temperature 100, pulse 82. On the afternoon of November 16th, the first urticarial wheals made their appearance on the body and legs. They were accompanied by a good deal of itching, remained out in one situation two or three hours and faded in large rings. Cough still troublesome. Was given an expectorant mixture and mag. sulph. in small doses every two hours. These medicines had very little effect on the rash which continued to appear until the 20th. Salol grs. 5, with quinine grs. 5, was then substituted for the salines. No rash appeared on the 22nd nor on any of the subsequent days. During all this time the patient's appetite was poor, his tongue thickly coated with yellowish fur, his bowels acted only after purgatives or enemas had been given, his temper was irritable, and he had little inclination to read or otherwise occupy his time in bed. His morning temperature was always normal. At night it reached its highest point about 7 o'clock, and commenced to fall shortly after reaching the normal again the following morning about 8. Defervescence was always accompanied by more or less sweating. There was slight cough, which released scanty tenacious mucus, in which a multitude of organisms were present, but none which gave promise of being the cause of the illness. No cultivations were made. Areas of dulness, which varied from day to day, were discoverable on examination of the lungs. These dull areas could be prophesied as being about to be formed by hearing some hours before a fine crepitant râle like that preceding the first stage of pneumonia. In no instance was there any pain of a pleuritic nature complained of, though a tightness on taking a deep breath was sometimes noticed.

As there was no improvement in the condition after several days, Dr. BARRIE, who conducts a sanatorium in the mountains at the south of Kiukiang, was called in consultation. It was decided that as the case might quite possibly be one of incipient tuberculosis, to try the mountain air and out-door treatment. No T.B. had as yet been found in the sputum after several examinations. Blood showed nothing except an eosinophilia.

The patient spent a month at an altitude of 4,000 feet, and returned at the end of that time with all traces of illness vanished except for the loss of weight and some impairment in the distinctness of the respiratory murmur over the extreme right base. During the time he spent in the hills, he was subjected by Dr. BARRIE to tests with tuberculin, and for Calmette's reaction. These were invariably negative, as was also Widal's reaction. Thoracocentesis was twice resorted to, in the expectation of finding fluid, but with negative results. Blood examination in Dr. BARRIE'S hands failed to show the presence of any parasites, but the eosinophilia had increased to 40 per cent., the highest in any of our cases. Fæces and urine showed nothing to be considered abnormal. Quinine was found to be the best drug to combat the persistent evening rise in temperature, and after its steady employment the temperature soon fell to normal, and remained there with only one slight relapse.

There was in the previous history of this case abundant evidence to show that the patient had frequently allowed the muddy water of ponds and creeks to come in direct and more or less prolonged contact with his unprotected skin.

A Report on a Few Cases of Yangtse River Fever.

By Surgeon W. W. D. Chilcott, R.N.

Case I.—McM————, J., 25, Able Seaman. This man was first seen at 9 a.m. on August 18th, 1908, at Shanghai. He then complained of pain in the lumbar region and cough. There were no physical signs in the chest, and his temperature was normal: he was not taken off duty and was given a simple cough mixture. At 1.30 p.m., I was called to see him and found him in a marked attack of dyspnœa: respirations 40, pulse 120, temperature 103. He was put to bed and given turpentine inhalations which afforded considerable relief. These were continued p.r.n., as there were two or three attacks of dyspnœa during the night. He was a little better next morning, but complained of a slight cough. His face was slightly cyanosed and eyes were suffused; there were no physical signs whatever in the chest or abdomen. The body was covered with a diffuse urticarial rash, also the arms and face. The patches were in some cases as large as a dollar, and in others even larger, owing to their having become diffluent. The urticaria could be induced in the ordinary way by stroking with the back of the nail. The patches were very hard to the touch and were annular in form in most cases: the centres of the rings were dead white, the rings themselves being rose colour. This rash persisted more or less severely to within two days of the temperature being normal, and was much more persistent than the ordinary urticaria, besides being much larger. For the next day or two the patient complained of pain in the stomach and diarrhœa, the bowels being opened as much as eight or nine times a day. The stools were watery, but contained no blood, mucus,

or worms. There was slight soreness and tenderness in the left iliac region, but otherwise no physical signs. He remained about the same till the 25th, when the temperature came down to a lower range and the diarrhœa practically ceased. For the next two or three days the temperature remained normal (the rash, however, persisting), but on the 30th it began to rise again. The man again complained of abdominal pain and slight tenderness. After persisting for a day or two the temperature remained normal and he was sent to duty. He was considerably wasted at the end of the disease. The onset was accompanied with a considerable amount of prostration and anorexia, which however went away after a couple of days. The urine was examined on two or three occasions, but revealed nothing abnormal. Blood films were also taken, but no parasites of any sort were found. There seemed to be an increase in eosinophiles, but this could not be substantiated as no means of counting them was at hand.

Remarks.—No drugs seemed to have the slightest effect on the disease. Salol in 10 grain doses t.d.s. seemed to have a beneficial effect on the abdominal symptoms but not on the temperature.

Diet also had very little effect on the course of the disease

Case II.—F————, S.T., 25, Stoker. This man came sick on September 3rd, 1908, at Wusung. He complained of pains in the back and limbs and general malaise. Temperature was 99·2. Bowels had not been opened for 48 hours. His body was covered with an urticarial rash, the characteristics of which were similar to Case I. He was given a purge and put to bed. In the evening he complained of cough. There were no

physical signs and no sputum. On the next day he complained of vague and fleeting pains in the left hypochondrium and of headache. The cough continued, but there were no physical signs. He was put on Salol. grs. x. t.d.s. with very little effect. He continued in much the same condition for a little over a week, when he started to improve slightly. The cough remained troublesome throughout, but without physical signs. On the 15th, the breathing was a little harsh in the right scapular region, but there was no other indication. After this he continued to improve and was eventually discharged to duty. His blood showed nothing abnormal; urine normal. There was no wasting in this case, and the appetite after the first few days was quite good. The rash was persistent in some part of the body, or other, throughout.

Remarks.—This case was not attended with so much prostration as was Case I., but in both cases the abdominal symptoms, temperature, and rash were very similar. Also the duration, in both cases, was a little over a fortnight.

In addition to the two cases above detailed, there were two cases of fever on board, at about the same time, in which malarial parasites were found in the blood; in these, however, the fever did not pursue a definite periodic course. There seemed to be something else present on which the malarial fever was grafted, as between the rigors the temperature still remained high. In addition to this, the urticarial rash above-mentioned persisted throughout the fever and was present before the administration of any drug.

Nearly the whole of the ship's company, at the time, suffered more or less from urticaria in some part of the body, usually the face. There were also transient rises of temperature in certain cases for no apparent cause.

Ætiology.—At the time these cases occurred the ship was moored alongside the International Dock, Shanghai. There was a patch of marshy ground within 29 yards of the ship. The boats had been placed near this for painting, and several of the men were employed painting them and doing other work in the immediate vicinity of this marsh.

The ship's water supply was tested again and again, but nothing obnoxious was found. All food coming into the ship was carefully inspected, and there was nothing about it that would lead one to suspect it of being the cause of the disease.

This fever has long been known on the Yangtse River under the names of Hankow, Shanghai, Kiukiang fever and so on, but nothing seems to be known as to its pathology, and treatment is merely a matter of expectancy. As far as I have been able to gather there is no mortality, although subjects of the fever are greatly pulled down for a time and are thus liable to other more serious diseases. I have heard of one or two cases where the symptoms were confined to the lungs and there were definite physical signs greatly resembling phthisis. The main difference being, of course, that no tubercle bacilli are found and the physical signs are very fleeting in character and extremely variable. Cases have also come within my knowledge in which the throat has been the main part to be affected, causing very distressing symptoms of dyspnœa, dysphagia, etc.

In the light of recent experience, I am inclined to think that the urticaria may affect any part of the body both inside and out. The dyspnœa in Case I. might easily be caused by it; also diarrhœa, due to urticarial œdema of the intestinal mucous membrane.

From the number of men affected at the same time the disease seems to be of an infective nature and it seems in some way connected with freshly turned soil.

The fact that the urticaria of the various parts causes the symptoms is I think undoubted, as they are for the most part so fleeting and indefinite. Therefore we must look for some cause for the fever and the urticaria. The disease is, as far as I know, entirely confined to the Yangtse River and is not mentioned in any text books.

Discussion.

Dr. G. M. Harston said he was afraid he could not say anything in elucidation of the disease. He had seen one or two isolated cases of a similar nature occurring in sportsmen who were in the habit of going into paddy fields without putties or other protection as regards their skin. He did not think the investigation of the disease had been quite complete. The author of the Paper had not told them exactly how the sputum was examined, and one would like further information on that point. The suggestion that infection was by the skin was sound, as all the facts noted about the disease seemed to point to infection in that way. He had seen about four cases of this nature in which there had been considerable symptoms in the way of abdominal trouble, and on examining the stools amœbæ had been found to be present. He looked upon this fact as merely a coincidence. In South China, where the climate was very mild, he had found the lung trouble confined principally to the larger tubes, and his patients did not get areas of dulness, such as those which had been described.

Dr. C. F. HARFORD said he would like to offer a few comments on what he thought was an exceedingly interesting paper, and he hoped that those who had had experience of the disease, or who could offer criticisms, would do so. He would point out in the first place that infection seemed to have taken place through wading in filthy swamps and pools, and after what had been recently heard in that room as to the method of infection by ankylostomes, he thought it seemed to suggest something of the same method of infection. Then the fact that blood counts showed marked eosinophilia would rather suggest that the disease might be attributable to some kind of worm. At any rate he hoped that those who had had experience in that direction would say whether they thought it probable that there was some worm infection, and that it might be acquired in somewhat the same way as Ankylostomiasis.

LIEUT.-COLONEL SIR WILLIAM LEISHMAN remarked with reference to the presence of eosinophilia that although it might be a sign of some worm infection, it was also a common feature with other skin diseases, such as psoriasis, eczema, etc., so that one should not build too much upon that characteristic.

DR. GRAHAM said he had, of course, seen a very large number of cases of urticaria, but he was not familiar with any cases of that type of disease in which there were fever or symptoms similar to those which had been described. He did not think the disease was necessarily attributable to the fact of having gone into paddy fields without being protected; he rather associated urticarial troubles with digestive disorders. Of course, many

people's occupations took them into all sorts of swamps and such like places. He had never noticed that any special lung trouble was associated with urticarial infection, but he thought the disease was fairly common.

Sir PATRICK MANSON said he had seen a good deal of urticarial trouble in the East, but never cases like those cited by the author. Assuming that the etiology of the disease suggested by the author was correct, viz., that the germ was acquired when walking through muddy fields, and through the agency of some animal, one would think that there ought to be some seasonal relationship; but of his cases one had been contracted in June, another in November—opposite seasons of the year. He questioned very much whether sportsmen would wander about the fields in June—a time of the year when there was no game to shoot and when the weather was unpleasantly hot. Possibly it was an erroneous idea that the infection was acquired in this way. Urticaria was often associated with things other than worms; the consumption of mitey cheese, for instance, was sometimes enough to bring about this condition; too much importance must not be attached to the presence of eosinophilia. The only suggestion he could make was that statistics should be carefully compiled as to the season of the year, sex, locality, and the number of cases. These statistics should be the first steps towards finding out the etiology.

Dr. F. M. SANDWITH said the writer of the Paper could feel assured that his communication had been listened to with great interest, and he (Dr. SANDWITH) hoped the author would give them, in the future, another paper with statistics on the subject. He (Dr. SANDWITH) could

not quite see that Dr. LAMBERT had proved his etiology. It was quite possible that he might be correct, but he (Dr. SANDWITH) thought they needed a little more information on the point. He noticed that the urticaria was by no means confined to the exposed parts of the skin; it affected even mucous membranes, which he imagined the insect (if there were one) could not have directly penetrated. He thought the writer must be correct in his assumption that both fever and urticaria were due to some toxin, though it was not yet known how the poison got into the body. The rapid disappearance of the eosinophilia would lead one to believe that it was entirely due to urticaria, for it was known that ordinary urticaria might be associated with an eosinophilia—as high as 60 per cent. (Emerson)—and, as Sir WILLIAM LEISHMAN had pointed out, there were certain other skin diseases, such as pemphigus, psoriasis, eczema, purpura, and scleroderma, in which eosinophilia might be present. The post febrile eosinophilia, too, must not be forgotten, occurring sometimes after pneumonia, rheumatic fever, chicken pox and measles.

A PROBLEM IN TYPHOID FEVER PROPHYLAXIS AND THE SOLUTION OF SAME.

By EMMETT I. VAUGHN, M.D., District Physician,
Gatun, Canal Zone.
Member of Department of Sanitation, Isthmian Canal Commission.

A brief description of the topography, inhabitants, and water-supply of the district of Gatun is necessary to enable one to intelligently grasp all the intricacies of a sanitary problem arising in the community. Roughly speaking, the district is bound east and west by ranges of hills, extending north towards the Atlantic Ocean, and on the south joining other ranges that zig-zag in various directions.

Seven miles from the Atlantic, the Gatun Dam extends across the low country connecting the two ranges of hills and entirely cutting off the flow of water, except for one opening, and it is through this that the output of the southern watersheds must find exit. The territory between the high lands presents miles of low marshy ground, intersected by small streams, which join the Chagres River before reaching the opening in the dam. During the months of November and December (our time of greatest precipitation) the streams overflow their banks and miles of territory are submerged anywhere from three to thirty feet. A rise of twenty feet in twenty-four hours has been recorded for the Chagres River, and as the work on the dam progresses the outlet for the water becomes less and less able to provide an adequate exit for the immense volume flowing from the

watersheds. When these floods, as described, subside there remains a residue of small ponds covering all the low territory, and proving excellent haunts for the mosquito.

On the high ground eastward of the dam is located the American town of Gatun, a model of tropical sanitation, provided with sewers, electric lights, modern plumbing, macadamized roads, streets, and all improvements that go to make up a civilized community. One mile northeast of Gatun is located a native town (called New Gatun) containing some 2,300 inhabitants, of which number 1,700 are Commission employees.

The total number of employees of the Isthmian Canal Commission in this district will average 6,900, of which number over 600 are natives of the United States, who occupy the higher class of professional, mechanical and clerical positions. The remaining 6,300 employees may be classed as "laborers," and it is from among these men that nearly all sanitary problems arise. These laborers represent the majority of the ethnological and theological variations of the human race.

All of the West Indian Islands, every Latin country of the Western Hemisphere, every country of southern Europe and every race of western Asia, have furnished their quota. Even Madagascar, Zanzibar, Ashantee, the Punjab and the Soudan have their many-hued denizens wearing the brass check of the Commission laborer.

With the various races, languages and grades of intelligence represented among this body of men, it is easily perceived with what facility epidemics spread, and how difficult they are of control.

The water supply for the district is furnished by the Gatuncilla River, one of the tributaries of the Chagres,

and it is this former stream that has been the chief source of our typhoid infection. A pumping station located on the low-lying banks of the Gatuncilla, about one mile south of the town of Gatun, supplies water to a 500,000 gallon tank, and from this latter it is piped to dwelling-houses, barracks, kitchens, messes, and all parts of the works.

The general preliminary work on the dam commenced during the fall of 1906, and the medical history of the district for the ensuing year was free of typhoid fever. On November 6th, 1907, our first case of typhoid fever was diagnosed, and in rapid succession new cases appeared until by December 26th we had a total of twelve cases—three Europeans and nine West Indians. In about 50 per cent. of these cases the clinical symptoms were so pronounced that there was little difficulty in making a diagnosis. I bring this point out as these cases presented an entirely different symptomatology from those in the succeeding epidemic, one year later.

At this time (1907) the facilities for the manufacture of distilled water were so limited that it was available only for the American employees and their families—the laborers drinking from the water taps or streams direct.

The area of work was, of necessity, spread over such a large territory that only in congested centres of operation were pit-closets in use. In many parts of the field men were defœcating and urinating whenever the spirit moved them, and it was utterly impossible for the foreman to accompany each individual laborer to a closet to make sure that he used it.

If I remember correctly, an analysis of the reservoir or tap water proved negative for B. Coli, and at this time

there was almost a complete absence of flies, so that an infection from both drinking water and possible fly contamination were ruled out. Investigation showed that several of the cases diagnosed as typhoid fever had been visiting other stations on the Canal Zone on Sundays and holidays, and as it was ascertained that at some of the towns typhoid fever was present, it was reasonably concluded that these places were the extraneous sources of our local infection.

Investigation into the personal habits of the twelve cases disclosed the fact that nearly all of them had, at different times, been imbibing water from small puddles and ponds adjacent to their work. Further inspection of some of these ponds and puddles, pointed out as drinking places, disclosed fæcal matter within short distances and, in one case, a pit-closet situated within ten feet of a much-used pond. From these facts it was reasonable to deduce that there lay the sources of infection of some of the cases.

Acting on the information gathered, steps were immediately taken to destroy the potability of this water by sprinkling crude oil on the surface, increase the number of pit-closets, and augment the supply of distilled water, so that each gang of laborers would have a safe water supply. In addition, every effort was made to impress on the laborers the dangers of drinking water indiscriminately, and the benefit of using only the distilled water. That these measures were in part successful is evinced by the fact that no more cases occurred in the district for one year.

During the period above described the average number of employees at work was about 2,800, and this number remained more or less stationary until the month of

August, 1909, when about 1,000 new laborers were thrown into the district to commence operations on the relocation of the Panama Railroad, which was to extend south from Gatun and traverse the watershed of the Gatuncilla River.

As long as this work was in close proximity to Gatun the men were quartered in cars, and availed themselves of the local pit-closet facilities; but, as the work advanced south, there was a proportionate disregard to the proper use of closets. Pit-closets were installed as rapidly as possible, and every effort made to force the men to use them, but without much success, while the use of distilled water was confined entirely to foremen, who had a day's supply sent out to themselves each morning.

It may be noted here that in the fall of 1907 the heavy rains had flooded the country, draining the watershed of the Gatuncilla, and it was this same water that was used most commonly by the laborers. This watershed area was at that time almost uninhabited, no engineering operations in force, and analyses of the water was negative for B. Coli.

As stated above, with the constantly increasing distance between Gatun and the camps of the railroad laborers, there was a corresponding increase in soil infection, with the result that, by November, 1908, when the heavy rainfall commenced, cases of typhoid fever appeared. Where the first cases originated that infected the watershed, I have never been able to ascertain, but they were probably the result of visits to infected towns.

It is reasonable to believe that, had any of the new laborers been infected on arrival here in August, the cases would have developed in the usual incubation period; but, as actually took place, our first case was reported on

November 6th, 1908, and a new one every third or fourth day thereafter, so that by January 1st, 1909, we had twenty-one recorded.

During the months of November and December we were unable to carry out typhoid prophylaxis to the best advantage because of the immense territory involved, and it was January 1st, 1909, before we had our system in good working order.

Analyses of the reservoir or tap water exhibited B. Coli in all samples, while the samples of distilled water taken from condensers, water carts, &c., were all negative. With the assurance that the distilled water was safe, attention was turned to the question of closets and flies.

A list was elaborated giving the location and number of all pit-closets in the district, including those on the railroad relocation, and measures taken to render each closet absolutely fly-proof. In addition to this, a daily disinfection of each closet was carried out—chloride of lime sprinkled over the outside premises, the whole interior washed down with 1-500 Bichloride solution, and crude carbolic poured into the pit. In the meantime dozens of new closets were erected on the line of the railroad, and policemen placed on duty to arrest anyone not using them.

All closets nearer than 100 yards to any kitchen or mess were removed and the site drenched with crude carbolic solution, the wire screening in these buildings examined daily for repairs, and warning notices regarding the accumulation of garbage and fly-breeding issued.

All peddlers exposing food for sale without a fly-proof covering were arrested and their licenses revoked and hundreds of circulars, in English, Spanish and French, warning against the use of impure water, distributed.

The distilled water for the living quarters was distributed by means of sixty-gallon barrels mounted on carts. The barrels were filled at condensers and carried to the various quarters where the water was emptied into the demijohns with which each house was provided. Each morning and evening the drivers of the carts had arms and hands thoroughly disinfected with bichloride solution, their temperatures taken, and exterior of the barrels washed down. In addition to these measures, each day steam at high pressure was turned into the barrels for a period of twenty minutes.

Strict precautions were also carried out in all kitchens and messes, all eating and cooking utensils cleaned with boiled water only, and vegetables usually served raw, such as celery, lettuce, &c., cleaned with distilled water only.

Particular attention was also paid to garbage cans to see that the covers were kept in place, that the cans were properly emptied when full, and all débris on the ground removed.

Investigations were made into the personal history of all members of the kitchen and mess forces and examinations made to determine whether or not bacilli carriers were harboured in these places. Both urine and stool specimens were obtained, and a number of examinations made—all of which proved negative.

January, 1908, produced 17 cases, February and March together 11, and April only one. From these results we believed that we had controlled the epidemic to a certain extent, and therefore, in some directions, relaxed our sanitary measures. During all this time the question of an entirely new general water supply had been agitated, but it was not until the month of May that a safe watershed was agreed upon, plans and estimates made, and work commenced.

The month of May, very much to our surprise, developed eight new cases of typhoid fever, June followed with thirty-five, and July with eighteen. Following the first case in May we immediately returned to all of our previous prophylactic measures and added new features.

About this time hundreds of the laborers, becoming tired of living in Commission quarters, where they were subject to more or less discipline, removed to the native town of New Gatun and installed themselves in rented rooms. In order to do this as cheaply as possible a number would rent a room together and divide the rent.

This resulted in overcrowding, and inspections later disclosed sometimes as many as six or eight men living in a room twelve feet square. Sewage and plumbing had not yet been installed in the town, and each house was provided with one or more of the ordinary pit-closets.

A number of cases appearing in the town, the living methods of the inhabitants were carefully investigated, and it was decided that, under the conditions present, fly contamination as a means for the spread of typhoid fever, was ideal. With this in view, daily inspections of each room in the town were inaugurated on June 17th, and continued until July 17th, and all cases in the slightest manner suspicious, immediately removed and forwarded to the base hospital at Ancon. Each case was considered as a dangerous one and isolated at once as though it were yellow fever or small-pox.

Daily examinations were also made of each individual working in the kitchens, messes, and engaged in carrying water. Temperatures were taken, physical examination made, and on the slightest suspicion of illness of any kind the men were forwarded to a hospital.

In the meantime samples of both distilled and tap

water were being analysed each ten days, and although the tap water continued positive for B. Coli and the distilled negative, yet the latter at times exhibited a high bacterial content, indicating contamination in handling. Whenever we noticed this condition in a sample from a certain cooler or cart steps were immediately taken to ascertain the cause and correct it.

In August the number of cases dropped to three, the last being reported on August 17th, and with the exception of an isolated case on October 2nd, the station has been free of typhoid fever to the date of this writing —December 8th, 1909. The daily inspections of kitchen, mess and water carrier personnel have been discontinued, as also those of living quarters; but analyses of water, disinfection of closets, supervision over the preparation and serving of food, garbage accumulation, and the regime of distilled water, are still in force. The town of New Gatun has now a well-equipped sewage and water system, modern flush closets have been installed in all houses and the old pit-closets demolished, set on fire, and the site disinfected.

The following table gives the list of our cases from November 6th, 1907, to December 1st, 1909:—

	Cases.		Cases.
1907—November ...	7	1909—May ...	8
December ...	5	(*contd.*) June ...	35
		July ...	18
1908—November ...	10	August ...	3
December ...	11	September...	0
		October ...	1
1909—January ...	17	November ...	0
February ...	5		
March ...	6	Total ...	127
April ...	1		

It is interesting to note that of these 127 cases there were only six members of the white race—two Americans and four Europeans (Spaniards and Italians). The few cases among members of the white races is attributed to the superior intelligence of these people, which enabled them to grasp the seriousness of conditions and protect themselves accordingly; while, on the other hand, the other races by eating and drinking promiscuously, and taking of their own accord no precautions at all, naturally fell prey to infection.

The most remarkable feature in connection with the epidemic of 1908-09 was the almost entire absence of the characteristic symptoms of typhoid fever in the majority of the cases. On first seeing these cases most of them gave a history of having had a slight malaise for about a week, but with no particular impairment of strength or appetite. Bronchial and abdominal symptoms were, as a rule, absent, and the thermometer usually registered 100° or under.

These cases were, as a rule, retained in the detention camp from twelve to twenty-four hours before they could be transported to the base hospital, and the majority were provisionally diagnosed as malarial fever, though, it is true that quinine taken during their short sojourn with us did not, apparently, have any effect on temperature curves. Many of the cases which exhibited the parasite of Laveran were afterwards, on blood culture, diagnosed as typhoid fever, showing the existence of both infections simultaneously.

At Ancon Hospital the clinical symptoms of the Gatun patients were so unreliable that diagnoses were made only on positive blood cultures of the B. Typhosus, and all cases of fever from this district were treated as "typhoid suspects" until proven otherwise.

The number of employees on duty in the district seemed to have no bearing at all on the number of cases, as evinced by the below data :—

1907—November	...	2,800	... 7
December	...	2,900	... 5
1908—November	...	2,800	... 10
December	...	2,700	... 11
1909—January	...	4,000	... 17
February	...	4,200	... 5
March	...	4,700	... 6
April ...	...	5,700	... 1
May ...	...	7,900	... 8
June ...	...	6,800	... 35
July ...	...	6,800	... 18
August	...	6,300	... 3
September	...	6,900	... 0
October	...	6,800	... 1
November	...	6,900	... 0

Another interesting feature of the history of these cases, is, that exactly 75 per cent. of the cases dated their illness during the first and last ten days of the month, while 25 per cent. only were taken ill during the middle ten days. Pay-day is invariably on the 15th of each month, and the following week is usually one of great dietary and alcholic excesses on the part of the laborer, and it has been suggested that this may have had some bearing on the incidence of the cases.

A résumé of the various methods of typhoid prophylaxis as used in this district is as follows :—

a. Provision for an adequate number of pit closets to be installed wherever needed, these to be supplemented by bucket closets and McCall Incinerators in places where the erection of the latter is

practicable. All closets to be disinfected daily and a number in sectional pieces to be kept on hand for immediate use whenever needed. An adequate number of foremen and laborers to supervise all work in connection with the closets.

b. An abundant supply of distilled water for all dwellings, kitchens and messes, together with a proper distribution of condenser plants, so that they will be available for water supply in any part of the works. A close watch to be kept on the handling of distilled water, to eliminate the chances of contamination, between the condenser and the receiver.

c. The prompt isolation of all cases—even those remotely suspicious.

d. Daily inspections of kitchens, mess and water carrier personnel and the prompt removal of any member on indications of illness.

e. Careful supervision of the methods of handling and cooking of all food supplies and the washing of cooking and eating utensils.

f. Daily room to room inspection of all living quarters and the immediate removal of all sick found therein.

g. Analyses of water samples each ten days.

h. Examination of certain suspect cases to determine whether they are "bacilli carriers" or not.

i. Close attention to pit-closet sites, as to their proximity to kitchens and messes.

j. Close supervision by police over food stuffs sold by peddlers, and prompt arrest of anyone violating sanitary regulations.

k. Distribution of posters in several languages, warning the employees of the dangers of using

impure water, and allowing fly-breeding to exist near living quarters.

l. The correct numbering of all houses and rooms therein so as to facilitate the tracing of cases advisable.

The question of anti-typhoid vaccination has not been discussed, for the reason, that, while its full value is realised, yet local conditions would militate against its effective use.

This article has, in no sense, been intended to be of a scientific nature, and all unnecessary technical terms have been omitted. It is simply a recital of a sanitary problem that frequently arises in tropical communities, and relates the steps taken to solve it from the standpoint of the general sanitarian rather than that of the physician dealing with individual cases.

Discussion.

Dr. F. M. Sandwith said this Paper was exceptionally acceptable to the Society because it came from a small but vigorous band of men who were fighting diseases under the Stars and Stripes. He thought the Fellows present were all authorities on the treatment of typhoid fever, but those who could stamp out an epidemic of this fever rapidly, or prevent its occurrence, deserved much more commendation than those who cured isolated cases.

Major S. Lyle Cummins said he could only speak with great diffidence on the matter. His present office, which was concerned with the preparation of a typhoid vaccine, had fixed his attention on the subject of typhoid in a particular manner, and he had only recently had charge

of half-a-dozen cases of typhoid carriers. In discussing this Paper, one would naturally ask whether it was infection by "carriers," or whether it was contamination of water supply that caused the outbreaks. On looking over the dates of origin of the cases in 1909, one noticed that eight cases occurred in May; then, in the next month, June, the number sprang up to 35, and then the cases were dotted about various months, ultimately disappearing in November. In that year, it rather looked as if the outbreak were connected with the period of greatest fly-prevalence. He thought it extremely hard to draw inferences as to the origin of an epidemic, especially when it had been described from a distance. Under the conditions described in the Paper, a "carrier" would be an exceptional source of danger to a community if he did not use the latrines, but deposited on the surface of the ground matter in which the development of *flies* took place to an enormous extent. He did not know whether the Fellows of the Society had read Major FAICHNIE'S recent contributions to the journal of the R.A.M.C. He ventured to call attention to what Major FAICHNIE had recently done on this subject in India. He found that flies, which had been in contact with a typhoid stool, absolutely carried the bacillus of typhoid fever in their intestines. By his experiments, it had been demonstrated that the fly acted as a natural "carrier" of typhoid fever. Flies, in a case of this kind, can carry typhoid in their bodies for 16 days. Therefore, a single human "carrier" —in conditions where flies breed freely—might be an enormous danger to the community. Another point was the question of vaccination against typhoid. While appreciating that the prophylactic measures described in the Paper were splendid, and that everything that could

be done in that way had been done, he thought that, where the number of labourers employed on the works was comparatively small, they should be subjected to vaccination against typhoid. Not only would you protect individuals in that way, but you would limit the number of susceptible persons, and thus lessen the danger for the whole community.

Dr. F. M. SANDWITH, in closing the discussion, said an interesting point in this Paper was the remark which ran as follows :—" Of these 127 cases there were only six members of the white race " ; and the author attributed this to the fact that white people were more intelligent in protecting themselves. He (Dr. SANDWITH) would like to point out that in the Tropics, in places such as India, Egypt, Sudan, and many parts of Africa, and in the case of the Italian Army at Massowa, it was always the white people who suffered in excess. Earliest records stated that the disease was unknown, then cases occurred among white men, and it was not until some time afterwards that the natives got it. In the Paper read to-night we had the converse : the natives contracted typhoid in a much greater proportion than the white people, who were usually considered more susceptible.

NOTES ON THE COMPARATIVE IMMUNITY FROM SLEEPING SICKNESS OF THE NGOMBE TRIBE, POSSIBLY DUE TO THE NKUSI DYE.

By GERALD CAMPBELL,
H.M. Vice-Consul, Congo State.

The Maringa-Lopori Zone of the Equator District of the Congo State lies roughly between the Equator and 2° N., and 20° and 24° E. (Greenwich). It has been a hotbed of sleeping sickness, especially on the river Lopori, where the riverine villages have all been wiped out or else the natives have retired into the forest. In the course of a ten days' canoe journey down stream from Simba (23° E.) to Basarkusu (20° E.), I only saw two small villages on the river. The inland natives still come to the water for fishing and other purposes, and this would account for the fact that many whom I saw away from the river showed signs of sleeping sickness in their eyes, etc., while in some cases the villages are built near small well-wooded and shaded streams leading to the main river. It is curious, however, that the Mongo tribe inhabiting the left bank of the Lopori is rapidly dying out, while amongst the Ngombe on the right bank cases of the sickness are comparatively rare. They are certainly more robust than the Bamongo, but the Rev. A. Ruskin, of the Congo Balolo Mission noticed, during a tour in the Ngombe region, that the flies would not go near the natives, and on being asked the reason, they suggested that it was on account of the dye which they put on their bodies. This dye, which they call Nkusi, is

prepared by scraping the kernel of a small palm nut and mixing the powder thus obtained with palm oil. It is then placed over the fire, and, as far as I could gather, charcoal is finally added. This substance is smeared over the body, especially on the neck and breast. It has a distinct odour, which can be distinguished in the specimens enclosed herewith. It is not to be supposed that the natives dye their bodies with this stuff with the express intention of keeping the flies off.

A further point, and one which is commonly remarked upon in the Congo, is that the tsetse flies rarely mount high from the level of the water. Thus, in a canoe or a small one-decked river steamer they are most troublesome, but on boats with an upper deck passengers are not often molested. On a single-decked steamer I sometimes found it necessary to have my mosquito net during a siesta on account of the tsetse flies, but I could dispense with it on larger boats with my cabin on an upper deck.

Discussion.

Sir Patrick Manson said he had nothing to add to what had been stated in the paper further than to say, that any contribution that might tend to increase their powers in dealing with this deadly and so widely prevalent disease would be welcomed. Lately they had had one or two proposals on the management of sleeping sickness, but, for the most part, when put into practice they had broken down; but it does not follow that the measure described, although it might seem mean and small—might not be of good if properly applied on scientific principles.

Sometime ago it was suggested by a Portuguese, MALDONADO (a cocoa planter in the Island of Principe, where sleeping sickness had become endemic and had killed off a large part of the population) that the number of tsetse flies might be limited by sending a man into the jungle clothed in some material coated with an adhesive substance. The suggestion was adopted, with the result that the man so covered captured, on the first day of the experiment, about 1,500 tsetse flies, and after the experiment had lasted a week or two, he could capture only a dozen tsetse flies in the course of a day. It might seem to some a childish idea, and possibly be despised in the laboratory ; nevertheless, it was effective in the case of Principe, and it ought to be welcomed and thoroughly tested as a means of reducing the number of tsetse flies and of combating sleeping sickness.

Dr. A. BAGSHAWE said he thought it would be interesting to see what the dye was made of. It might be some substance which was found in many parts of Tropical Africa, and if it were of service they might be able to bring it into use. With reference to MALDONADO'S idea, the essence of it was that the cloth which was used had to be black. The tsetse flies, like other biting flies, were attracted by dark surfaces, and would therefore be much more likely to settle on black cloth than on any light-coloured material.

Mr. E. E. AUSTEN said he could confirm Dr. BAGSHAWE'S statement that tsetse flies—like other biting Diptera—prefer dark surfaces. That was believed to be due to the fact that such surfaces are warmer than light surfaces, and therefore as a matter of practice anything

in the shape of a fly trap ought to be of a dark colour. When hunting for mosquitoes in the lunatic asylum at Kissy, in the vicinity of Freetown, Sierra Leone, the insects were invariably found on the dark portion of the walls. With regard to the employment of odoriferous substances in order to repel tsetse flies, there had been an old idea ever since the days of Livingstone that in South Africa the method of keeping off *Glossina morsitans* adopted by the old elephant-hunters and other pioneers, was to smear their oxen over with some evil-smelling compound, composed of cow-dung and other matters; how far it was efficacious he (Mr. AUSTEN) did not know. There was a point which had not been alluded to, but which he thought had a bearing on the destruction of *Glossina palpalis*, and that was the peculiar mode of reproduction of tsetse flies, which was almost unique—not absolutely unique but very rare in Diptera. Instead of the female laying as was usual a large number of eggs, it produced a living larva, which was retained within the body of the mother until fully grown; only one larva was produced at a time, at an interval of from eight to ten days. Since, therefore, each female tsetse fly could only bring into the world a far smaller number of progeny than in the case of an ordinary fly, which produced several hundred eggs, the prospects of ultimate benefit from wholesale methods of tsetse fly destruction were distinctly encouraging. He believed Dr. BAGSHAWE was now firmly convinced that the true method of combating Sleeping Sickness lay more in the direction of attacking the fly itself than in segregating the natives and attacking Trypanosomiasis in that way; and he (Mr. AUSTEN) thought that if one could find an efficacious mode of dealing with *Glossina palpalis*, it would give

more hope of success than in the case of the ordinary fly, for the destruction of female tsetse flies would obviously have a much greater effect on the tsetse fly population of a given district, than would be attained in the case of, say, house-flies, by the destruction of the same number of females of *Musca domestica*.

Dr. C. F. HARFORD said they were all aware that ever since it was known that biting insects were the means of conveying disease, a large number of substances had been suggested which might protect individuals against the bites of the flies. Possibly one of the reasons why these suggestions were rejected was that, on the one hand, they might produce a false sense of protection, and, in consequence, lead to the neglect of safer methods of protection. Another reason was that these protective substances were often extremely objectionable, and in some cases the remedy appeared to be almost as bad as the disease. On the other hand, an African liked to smear his skin with a greasy substance; and as he did not seem to mind how nasty the substance was, it might be a distinctly good plan to endeavour to find a substance which the African would use in this way. It would not prevent other measures being adopted, because they would not, probably, adopt other measures, except under constraint.

Reprinted by
G. C. M. PRINTING SERVICE LIMITED
43 HUMBERSTONE ROAD, LEICESTER
1951